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A FACTOR STUDY OF THE TRAITS OF THE DIONNE
QUINTUPLETS

LEONARD W. FERGUSON



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A FACTOR STUDY OF THE TRAITS OF THE DIONNE QUINTUPLETS¹

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Blatz in his book, *The Five Sisters* (1), presents data which enable one to rank the Dionne quintuplets on 23 mental, physical and social traits. These traits together with the rank orders (computed by the writer) of Annette, Cecile, Emilie, Yvonne and Marie are shown in Table I: Explanatory remarks concerning each of the traits rated appear below:

1. *Weight at birth*: Rank 1 indicates heaviest child, rank 5 the lightest.
2. *Weight at 18 months*: Same as item 1.
3. *Height at birth*: Rank 1 indicates tallest child, rank 5 the shortest.
4. *Height at 2 years*: Same as item 3.
5. *Vocabulary at 24 months*: Rank 1 indicates child possessing largest vocabulary, rank 5 child with smallest.
6. *Vocabulary at 36 months*: Same as item 5.
7. *Mental age, 11 months*: Rank 1 indicates most intelligent, rank 5 least intelligent child.
8. *Mental age, 21 months*: Same as item 7.
9. *Mental age, 35 months*: Same as item 7.
10. *Eating cooperativeness*: Rank 1 indicates most cooperative child, rank 4 the least cooperative child.
11. *Inattention while eating*: Rank 5 indicates child most attentive, rank 1 indicates child most attentive.
12. *Second servings, 3 years*: Rank 1 indicates the child who had the most frequent number of second servings, rank 5 the child who had the least.
13. *Third servings, 3 years*: Same as item 12, except that reference is to third servings rather than second.
14. *Noncompliance*: Rank 5 indicates the most compliant

¹ Recommended for publication by Dr. J. R. Kantor, February 27, 1940.

child, rank 1 the least compliant.

15. *Discipline*: Rank 1 indicates the child who had to be disciplined the most frequently, rank 5 the one who had to be disciplined the least.
16. *Anger (thwarting by adult)*: Rank 1 indicates the child least likely to react, rank 5 the child most likely to react.
17. *Anger (unsatisfied demands)*: Same as item 16.
18. *Anger (thwarting by child)*: Same as item 16.
19. *Anger (inability to handle material)*: Same as item 16.
20. *Fear (change in routine)*: Same as item 16.

TABLE I
TRAIT RATINGS OF THE DIONNE QUINTUPLETS

No.	Trait rated	Rank Order				
		Y	A	C	E	M
1.	Weight at birth	1	2	3	4	5
2.	Weight at 18 months	1	2	3	4	5
3.	Height at birth	1	2	3	4	5
4.	Height at 2 years	1	2	3	4	5
5.	Vocabulary at 24 months	2	1	3	5	4
6.	Vocabulary at 36 months	1	2	5	4	3
7.	Mental age at 11 months	1	3	2	4	5
8.	Mental age at 21 months	1	2	3	4	5
9.	Mental age at 35 months	1	3	2	4	5
10.	Eating cooperativeness at 3 years	3	1	4	2	5
11.	Inattention while eating at 3 years	4	1	3	2	5
12.	Second servings at 3 years	2	1	5	4	3
13.	Third servings at 3 years	2	1	5	3	4
14.	Noncompliance	4	5	2	1	3
15.	Discipline	4	1	3	2	5
16.	Anger (thwarting by adult)	4	3	5	2	1
17.	Anger (unsatisfied demands)	3	2	1	5	4
18.	Anger (thwarting by child)	3	5	4	2	1
19.	Anger (inability to handle material)	3	5	2	1	4
20.	Fear (change in routine)	1	5	2	4	3
21.	Fear (unusual organic experience)	4	1	2	3	5
22.	Social popularity	1	4	2	3	5
23.	Social interest	3	1	2	4	5

TABLE II
INTERCORRELATIONS AMONG THE TRAITS LISTED IN TABLE I*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.	1.0																						
2.	1.0	1.0																					
3.	1.0	1.0	1.0																				
4.	1.0	1.0	1.0	1.0																			
5.	.8	.8	.8	.8	.8																		
6.	.6	.6	.6	.6	.6	.6																	
7.	.9	.9	.9	.9	.9	.9	.6																
8.	1.0	1.0	1.0	1.0	1.0	1.0	.8	.6															
9.	.9	.9	.9	.9	.9	.9	.6	.3	.1														
10.	.5	.5	.5	.5	.5	.5	.4	.3	.2	.1													
11.	.3	.3	.3	.3	.3	.3	.3	.1	.1	.3	.1												
12.	.5	.5	.5	.5	.5	.5	.7	.9	.1	.5	.1	.5											
13.	.6	.6	.6	.6	.6	.6	.6	.8	.2	.6	.2	.8	.2										
14.	-.6	-.6	-.6	-.6	-.6	-.6	-.9	-.8	-.3	-.6	-.3	-.3	-.1	-.9									
15.	.3	.3	.3	.3	.3	.3	-.1	-.1	-.1	-.1	-.1	-.1	-.1	.9	.1	.0	.2	.5	.1	1.0			
16.	-.7	-.7	-.7	-.7	-.7	-.7	-.5	-.1	-.9	-.7	-.9	-.1	-.2	.2	.1	.1	-.2	1.0					
17.	.5	.5	.5	.5	.5	.5	.7	-.1	.6	.5	.6	.0	.2	0	-.1	-.4	-.2	-.8	1.0				
18.	-.7	-.7	-.7	-.7	-.7	-.7	-.8	-.1	-.6	-.7	-.6	-.6	-.7	-.3	-.4	.5	-.7	.7	-.8	1.0			
19.	-.2	-.2	-.2	-.2	-.2	-.2	-.7	-.6	-.1	-.2	-.1	-.1	-.1	-.8	-.5	.9	0	-.2	-.3	.3	1.0		
20.	.3	.3	.3	.3	.3	.3	0	.1	.6	.3	.6	.6	.6	-.7	-.3	-.4	.1	-.7	-.5	.2	.2	.3	1.0
21.	.4	.4	.4	.4	.4	.4	.5	-.2	.3	.4	.3	.7	.9	.1	.3	-.2	.9	-.5	.6	-.9	-.1	-.5	1.0
22.	.7	.7	.7	.7	.7	.7	.2	-.1	.9	.1	.0	-.2	0	.1	.1	-.8	.3	-.3	.7	.1	1.0		
23.	.7	.7	.7	.7	.8	.1	.6	.7	.6	.6	.7	.3	.4	-.5	.7	-.7	.8	-.10	-.3	-.2	.9	.3	1.0

* Variables 14, 16, 18, and 19 were reflected permanently for the analysis.

21. *Fear (unusual organic experience)*: Same as item 16.
22. *Social popularity*: A ratio "comparing the number of times each child attempts to open social negotiation with another and the number of times each of the other children attempt to do the same towards her." Rank 1 indicates the most popular child, rank 5 the least popular child.
23. *Social interest*: A ratio "comparing the number of times each child watches each of the other 4 with the number of times she herself is watched by each of the others." Rank 1 indicates the child possessing the most social interest, rank 5 the child having the least.

Rank order correlations among all the traits rated are given in Table II. Because there are no sampling errors (i.e., the entire population of Dionne quintuplets was tested) all correlations not actually zero are statistically significant. A centroid analysis of these correlations yields 4 statistically significant orthogonal factors.

For the analysis the communality of each trait first was assumed to equal the highest correlation in the appropriate column. Finding later that the communalities computed from the factor loadings did not in every instance agree with those which had been estimated, the analysis was repeated with communalities of 1.00 in each column. This time the estimated and computed communalities agreed perfectly.

All the fourth factor residuals are (practically) zero, the magnitude of the largest being .003. The fact that there are any this large certainly can be attributed to inaccuracy introduced by using only 3 rather than 4 or more decimals in the computations.

It can be concluded, therefore, that four independent factors are the minimum number that may be postulated to account for the observed intercorrelations. It should be noted, also, that the variance of every trait is completely determined. There are no specifics left to be explained. The results of the centroid process are shown in Table III.

Since the unrotated factor loadings make little, if any, psychological sense it was necessary to rotate them in an attempt to

TABLE III
RESULTS OF THE CENTROID ANALYSIS*

	Centroid Loadings				Rotated Loadings				h^2
1.	.950	.262	.067	.085	.999	.004	-.000	-.004	1.00
2.	.959	.262	.067	.085	.999	.004	-.000	-.004	1.00
3.	.959	.262	.067	.085	.999	.004	-.000	-.004	1.00
4.	.959	.262	.067	.085	.999	.004	-.000	-.004	1.00
5.	.896	-.189	.250	-.314	.801	-.377	.461	.052	1.00
6.	.530	.074	.820	.210	.603	.461	.642	-.116	1.00
7.	.808	.553	-.184	-.086	.897	-.126	-.332	-.261	1.00
8.	.959	.262	.067	.085	.999	.004	-.000	-.004	1.00
9.	.808	.553	-.184	-.086	.897	-.126	-.332	-.261	1.00
10.	.606	-.473	-.142	.626	.504	.166	-.031	.848	1.00
11.	.479	-.616	-.479	.402	.303	-.190	-.136	.924	1.00
12.	.555	-.362	.734	.157	.504	.230	.804	.218	1.00
13.	.644	-.346	.464	.502	.605	.374	.501	.495	1.00
14.	.681	-.283	.626	-.253	.602	-.147	.784	-.005	1.00
15.	.479	-.616	-.479	.402	.303	-.190	-.136	.924	1.00
16.	.681	.411	-.521	-.308	.696	-.479	-.501	-.184	1.00
17.	.618	-.040	-.339	-.709	.497	-.857	-.035	-.130	1.00
18.	.858	-.316	-.356	-.191	.700	.587	-.009	.405	1.00
19.	.341	-.521	.665	-.413	.204	-.271	.940	.016	1.00
20.	.076	.949	.065	-.302	.295	.085	-.344	-.888	1.00
21.	.606	-.538	-.587	-.007	.402	.567	-.156	.703	1.00
22.	.530	.768	-.328	.152	.696	.125	-.641	-.298	1.00
23.	.858	-.316	-.356	-.192	.700	-.587	-.009	.405	1.00
Sum		.002	.004	.015					

* Since variables 14, 16, 18, and 19 were reflected permanently for the analysis, in interpreting them the signs should be reversed.

arrive at simple structure. Height and weight, being easily identifiable as indices of physical maturation, seemed a good locus through which to pass one of the axes. After the necessary rotations were made axes III and IV, then II and IV and finally II and III were rotated to (what seemed to the writer) the best fitting positions. The final (rotated) loadings appear in Table III. Simple structure has not been attained. Because the factorial description of a test is not independent of the fact that the tests are assembled in a particular battery unless simple structure has been shown to exist (Thurstone, 3, p. 91) it seems unwise to attempt a categorical description of all the factors. This conclusion is rather disconcerting since the analysis has shown that the hypothesization of four factors completely explains the variance of each trait.

If we confine our interpretation to Factor I the picture is not quite so gloomy. In this case, since 100 per cent of the variance

of height and weight can be attributed to it, there seems to be implied quite definitely a maturational process. Whether this process is wholly hereditary or at least in part environmental cannot be determined so the reader should not jump unreservedly to the conclusion that the portion of the variance attributable to this factor is due to innate in contrast to acquired characteristics. It is interesting to note, however, the relative contributions of this factor to the variance of the different behavioral traits (see Table IV).

TABLE IV
PER CENT OF THE VARIANCE OF EACH TRAIT
ATTRIBUTABLE TO FACTOR I*

1.	100.0	9.	80.6	17.	24.7
2.	100.0	10.	25.3	18.	49.1
3.	100.0	11.	9.2	19.	4.2
4.	100.0	12.	25.4	20.	8.7
5.	64.3	13.	36.5	21.	16.1
6.	36.3	14.	36.3	22.	48.4
7.	80.6	15.	9.2	23.	49.1
8.	100.0	16.	48.5		

* In the final rotated position.

Of considerable interest is the fact that Factor I contributes 100 per cent of the variance of mental age at 21 months, and 80.6 per cent of the variance at 11 and 35 months. If Factor I is a maturational process determined wholly by heredity then Burks's contention that 80 per cent of the variance in intelligence is attributable to innate in contrast to environmental influences (2) is in remarkable agreement with the above figures. Although the comparison is striking the writer is extremely skeptical of its significance. He is well aware of the many loopholes that abound in this line of reasoning.

In marked contrast to the above figures, 9.2 per cent of the variance of inattention, 4.2 per cent of the variance of anger due to inability to handle material, 8.7 per cent of the variance of fear due to change in routine and 9.2 per cent of the variance of discipline are attributable to Factor I. All these traits are commonly

considered to be non-intellectual in nature.

Anger resulting from thwarting either by child or adult, social popularity and social interest are traits which have almost but not quite half (48% to 49%) of their variance determined by Factor I.

The part of the variance of vocabulary that is determined by Factor I drops from 64.3 per cent at 24 months to 36.3 per cent at 36 months revealing (if Factor I is maturation) with increasing age the greater influence of determinants non-maturational in nature.

For reasons already given no attempt will be made to describe accurately any of the other factors. Observation of the rotated loadings suggests a factor of training or conformity producing factor (IV), and two emotional factors: (1) Escape—Fear (III); and (2) Frustration—Aggression or anger (II). Since the axes cannot be located uniquely the interpretations are doubtful and, of course, the proportion of the variance that each factor contributes to the various traits cannot be determined.

SUMMARY

From data presented by Blatz (1) the writer determined the rank order of the Dionne quintuplets on 23 mental, physical and social traits. Rank order correlations were computed and the matrix factored by the centroid method. It was found that 4 factors will account for all the intercorrelations and for 100 per cent of the variance of every trait. Simple structure, however, could not be obtained. Consequently a psychological description of only one factor, alleged to be a maturational process, is attempted. Its relative contributions to different traits are summarized.

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